Spatial housing economics: a survey

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Accepted Version

SPATIAL HOUSING ECONOMICS: A SURVEY

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Introduction

What contribution can economics make to an understanding of how housing affects the spatial structures of urban areas? Given these spatial structures, what can economics say regarding the impact, if any, of housing on the life chances of urban residents and economic performance of the wider economy? In this introduction to a virtual special issue on spatial housing economics, I highlight the achievements of and issues still facing urban researchers seeking to answer these questions. I then outline some promising methodological directions for future urban housing economics research to explore.

Given my stated purpose, it is important to note at the outset that while many accept housing to be an inherently spatial phenomenon, analysis of the time-series behaviour of aggregate housing market fluctuations remains (with some important exceptions) the province primarily of macroeconomists and the finance community. As a consequence, a somewhat artificial distinction is required in order to limit the scope of this review article and to remain within the focus of *Urban Studies*.

My discussion of future directions is set within the context of the past development of the field, starting with the neo-classical residential location model, which subsequently spawned research in housing economics in a wide range of directions including hedonic models, spatial econometrics, neighbourhood models, housing market areas, housing supply and models of segregation. In addition we need to consider research on social interactions, including extensions to the classic Schelling model and work on path dependence.

Approaches in Spatial Housing Economics

Early Foundations of the Subject

The development of the monocentric model is sometimes represented as the birth of modern urban economics, although its antecedents lie more than a century earlier in Ricardo's and Von Thünen's work. Even if the monocentric model was not a scientific revolution or paradigm shift, as defined by Kuhn, it has certainly been the strongest influence on the programme for subsequent urban theoretical and empirical research in housing economics.

The foundations, arising from the work of Alonso (1964), Evans (1973), Mills (1972), Muth (1969) and Wingo (1961), formulate a theory of commuting and urban land values, and the relationship to spatial household residential patterns. The model shows how rents, land values and population densities all decline as the distance from the city centre increases. Although pre-dating the development of the theory, Clark's (1951) test of urban population densities provides a classic study based on the negative exponential function. Since Clark's original work, density gradients have been studied extensively for later periods, but the basic conclusions still generally hold, although it does not fit in all cases, for example in polycentric cities that grew by joining together formerly distinct cities.

Dynamics can be incorporated into the monocentric model through the longevity or durability of the housing stock. Brueckner (2000) surveys models which assume either that housing is irreversible, so that the stock is entirely determined by history, or can be redeveloped according to obsolescence conditions. In contrast to the static model where building heights decline smoothly, longevity provides a characterisation more consistent with observed urban patterns; the age of the stock is as important as its location in determining density. Empirical evidence indicates that redevelopment occurs when the price of land for new development exceeds the price of land in its current use by the cost of demolition (see Brueckner 1980, Wheaton 1982, and Rosenthal and Helsley 1994). Glaeser and Gyourko (2005) suggest that modern work on urban dynamics ignores the link with housing and the physical structure of cities. Cities exhibit asymmetric responses to periods of growth and decline; because of the durability of the housing stock, cities grow faster than they decline, so that urban decline is persistent. This arises because, at least in the US case, new supply is elastic in the upswing when prices are rising faster than construction costs, but the stock of units is inelastic in the downswing since the existing stock cannot be reduced quickly, for example, by demolition. In addition, Gyourko and Saiz (2004) demonstrate how renovation expenditures on the existing stock decline strongly in areas where market values are below construction costs. These are examples of spatial lock-in; once areas have been developed, it becomes difficult to change the characteristics of an area.

On Migration and Segregation

The basic version of the monocentric model provides a neat explanation of segregation between rich and poor households, based on differences between the income elasticity of housing demand and the income elasticity of the marginal valuation of commuting time. If the income elasticity of demand for space is high, this is consistent with a concentration of high income households locating away from the centre. But, if high income households respond strongly to higher travel times, then it

is possible that the rich will be concentrated in the centre. The model predicts that segregation between household types is likely to be the norm, but does not necessarily predict the location of the rich. Modern research has developed the model in many directions. Particularly important is the development by Brueckner et al. (1999), who use differences in urban amenities as a means of overcoming the potential indeterminacy of the location of the wealthy in the standard model.

Empirical residential location and mobility models take into account not only distance and neighbourhood but a variety of socio-economic influences. Mobility and migration have been important issues in the housing literature since the 19th century; Ravenstein's (1885) first law states that the majority of moves are only short distances and this remains the case today. The Survey of English Housing, for example, indicates that in 2005/6, 70% of movers travelled less than 10 miles. For social tenants, the figure rises to over 80%. Similar patterns appear to exist in other developed countries. Furthermore, most households move not for labour market reasons, but to improve their quality of area and dwelling or because of demographic change such as marriage or divorce. Indeed most modern work on mobility and location, using both aggregate time series and micro data sets, considers a large class of variables in addition to labour market factors; these include tenure, relative house prices and housing availability, income and social status of both the household and the area, age, gender, marital status and the presence of children (for the UK see Böheim and Taylor 2002, based on micro data and Cameron and Muellbauer 1998 on time-series data).

The role of housing tenure has attracted considerable attention; there is little doubt that private renters have higher rates of mobility, although this partly reflects the fact that renters are typically younger. Studies also, generally, find social tenants to have low rates of moving. The early studies of Hughes and McCormick (1981, 1985, 1987, 1990) were particularly influential in the UK. But, Böheim and Taylor (2002) argue that social tenants may have higher moving probabilities than owners with mortgages in periods when owners are facing negative equity, which locks households into their homes and reduces spatial mobility. Henley (1998) also finds strong support for the lock-in hypothesis. In the US, Chan (2001) provides evidence that negative shocks to house prices generate reductions in mobility through spatial lock in. The work of Bover et al. (1989), and Cameron and Muellbauer (2001) both provide support for the view that high house prices reduce in-migration. However, it does not necessarily follow that high prices increase migration outflows. For those who are already owners in the region, an increase in prices is a benefit rather than a loss. More generally behaviour depends on expectations of relative capital gains between the regions, a point stressed by Cameron and Muellbauer (1998).

Recent Research on International Migration, Housing and Tenure

Recent research considers the effects of international migrants on both house prices and the displacement of domestic residents. But increases in migrant numbers do not necessarily translate into a proportionate increase in housing demand since household formation rates may differ from the domestic population and tenure choices take time before they converge towards those of indigenous residents. Nygaard (2011) models the headship rates and tenure choices of UK migrants between 2003/4 and 2005/6; he finds that the length of time an individual has been in the country has only a limited effect on variations in the probability of being a head of household, but a major impact on the probability of becoming an owner-occupier. International studies are considered below. It might appear self-evident that an increase in immigration should generate rises in house prices, particularly in areas where migrants are heavily concentrated. But, in fact, it depends on the spatial scale. At a wide scale, Gonzalez and Ortega (2013) find that house prices and new construction across the Spanish provinces were strongly positively affected by an immigrant inflow between 1998 and 2008. The evidence also suggests that prices rise at the city level, where Saiz (2007) provides strong support for the US and Accetturo et al. (2014) for Italy. But the prices of dwellings *within* the neighbourhoods where migrants concentrate may fall. The outcome depends on the income of migrants, the price elasticity of housing supply and displacement of domestic residents to other areas. The last has received particular attention, both in the UK and elsewhere. Recent work for the UK includes Hatton and Tani (2005), Gordon (2014) and Sá (2014). Hatton and Tani find dispersion even at the regional scale; Card et al. (2008 show that native outflows in the US only takes place once migrant shares reach critical levels. For the English local authorities, Sá (2014) finds evidence that displacement produces a negative effect on house prices, which is particularly strong where low-skilled migrants replace higher-skilled domestic residents. A similar negative relationship, within US cities, between the growth in house prices and changes in local immigrant shares is found in Saiz and Wachter (2011).

Hedonic models also imply that additional factors to distance from the city centre affect house prices, including neighbourhood quality. Based on hedonic analysis of micro data, Cheshire and Sheppard (1995, 1998), show that for two British towns, an extended form of the monocentric model, allowing for differences in locational characteristics, holds. Therefore, distance from the centre still matters, despite long-run falling transport costs (and a flattening on the rent gradient), but more attention needs to be paid to the neighbourhood, including local crime rates (Gibbons 2004) and the quality of local education (Cheshire and Sheppard 2004).

Spatial Econometrics

Hedonic models also provided an early framework for the use of spatial econometric techniques in order to determine the extent to which property prices are related across space; although originally applied primarily to large cross-section data sets, the methods have expanded to be used in panel data for example. Whereas spatial econometrics was, at one time, a fairly specialised field, it has attracted increasing attention and applications from mainstream economists/econometricians. Perhaps the two most commonly discussed features of spatial data are the presence of spatial dependence and spatial coefficient heterogeneity. Dependence arises because housing typically consists of a set of interlinked local markets. Heterogeneity measures the extent to which local markets exhibit structural variations, because of different household characteristics in each location or property types. This provides one approach to the measurement of housing market areas (Jones et al. 2005, Leishman 2009, Maclennan and Tu 1996). The use of regional or other administrative area data sets that do not correspond to local housing market areas will often introduce spatially correlated errors. Many forms of neighbourhood effect, e.g. Can (1992), Can and Megbolugbe (1997) also give rise to the possibility of spatial lags, where prices depend on prices in neighbouring areas, rather than correlation arising through the error terms.

Sub-National House Price Dynamics and the Ripple Effect

Furthermore, spatial coefficient heterogeneity, that is the extent to which the coefficients vary over space in either a random or non-random manner, is important for modelling the dynamics of regional house price change, the extent to which some areas are leaders and the degree to which convergence is re-established over time (the so-called ripple effect); this is an area which has attracted increasing attention in recent years, using a wide variety of techniques, including cointegration and spatial econometrics (see Cook 2003, 2006, 2012, Cook and Holly 2000 and Cook and Watson 2015, for a range of techniques). Arguably, the development of methods to analyse the data has run ahead of the theory capable of explaining the drivers of spatial price differences and convergence; migration is, perhaps, the most widely cited explanation, but the evidence is not entirely convincing. Meen (1999) suggests that, for England, regional differences in the response to national policy changes (for example monetary policy) are part of the explanation. This shows up in heterogeneous, but non-random spatial coefficients. Although much of the early work on ripple effects took place in England and, in a small country such as England, co-movements are, perhaps, unsurprising, an increasing volume of evidence indicates that a lead city or area also occurs internationally and that prices, in some cases, converge. Examples include: Gupta and Miller (2010, 2012), Holmes et al. (2011), Barros et al. (2012) all for the USA; Berg (2002, Sweden); Stevenson

(2004, Ireland); Luo et al (2007, Australia); Shi (2009, New Zealand); Chen et al. (2011) and Lean and Smyth (2011) – both Taiwan; and Balcilar et al. (2013, South Africa).

Social Interactions and Agent-Based Models

A different crucial strand of research, not necessarily based on the monocentric model, involves the modelling of social interactions, where the decisions of one agent depend on the actions of others. The Schelling (1971) model of residential segregation provides the classic example - the utility of each individual is a function of the (racial) composition of others who decide to live in the area. Analogies to the complex systems used in the biological sciences can be drawn to show how non-linearity and phase transitions arise. Meen and Meen (2003) demonstrate how neighbourhoods can reach thresholds, tip and gentrify; neighbourhoods are not permanently stable, although they can exist in the same state for long periods, but when they change, they change suddenly. These models provide insights into the possible dynamics of cities, but the number of practical applications to spatial housing markets is still modest and Galster et al. (2007) find limited evidence of thresholds across a wide variety of variables in the US. Yin (2009) is one of the few published spatial housing applications of the methods, although Geanakoplos et al. (2012) apply agent-based methods to the modelling of housing systemic risk.

Although the approach is very different from the monocentric model, the interactions between agents, following low-level rules, create higher levels of order where segregation is the most likely outturn. In neo-classical models all individuals are, typically, identical or representative, but complex systems stress the heterogeneity of agents and behaviour can be simulated through agent-based computation models, for example through cellular automata (CA). Interactions models also illustrate the importance of networks and human geographers and regional scientists have applied CA models to a wide range of urban problems (see Batty, 2005 or Portugali, 2000 for overviews of the field). The stability of segregation can be shown using a stochastic version of the Schelling model developed by Young (1998, 2001) and Zhang (2004, 2004a). Thresholds and phase transitions are features of social interactions models, but once areas have undergone a phase transition, they are locked in to the new state, except in the presence of large shocks. The states are, therefore, persistent. Similarly, Durlauf (2006) defines poverty traps as limiting cases of economic immobility or as states in which the persistence of economic conditions is arbitrarily long.

Neighbourhoods and Economic Performance

A major focus of recent research has been on the relationship between neighbourhoods, economic performance, inequality and segregation, including the role of housing, drawing on the social

interactions and poverty traps literatures. This work, which attempts to reach conclusions about the effects of neighbourhoods on economic outcomes for adults and children, is extensive, but remains controversial and incomplete. The empirical problems are serious and include issues of identification, endogeneity and residential sorting. Solutions have been proposed (see Galster et al. 2010 for a summary), but it is probably fair to say that convergence upon a common approach has not yet been achieved. There is little doubt that the most impoverished households live in the worst housing and neighbourhoods, but this is unsurprising if the supply of the best locations is limited. High income households will outbid low income groups for the prime sites, but this does not imply that deprived neighbourhoods in themselves cause poverty.

Housing the Elderly

Perhaps the two major demographic changes facing developed economies are the increases in (young) migrants under globalisation and the ageing of domestic populations. Considerable attention has been paid to the former, but rather less to the latter. But down-sizing, empty-nesting and so-called over-consumption of housing by older households are important issues. Equally, more attention needs to be paid by housing economists to the support required by the elderly, given the increasing mobility of offspring and the breakdown of support networks. Inadequate resources to provide care within the family home or in the community is a time bomb, which governments have not been willing to address fully (see Bell and Rutherford, 2012, for an analysis of the issues). Ong et al. (2015) discuss the housing transitions of older households in Australia.

Path Dependence, Lock-in and Urban Structures

Persistence, or more precisely path dependence, is a feature of a third strand of the literature relevant to housing economics and urban systems; a path dependent process is one whose evolution is determined by its own history. North (2005) points to “constraints on the choice set of the present that are derived from historical experiences of the past”. Formally, a path dependent (non-ergodic) stochastic process is defined in terms of the limiting probability distribution which governs the system dynamics (David 2007). For many markets, an assumption of ergodicity is reasonable, but, arguably, this is not the case in housing. Under this approach, multiple equilibria are possible, but the final outcome amongst the possibilities is determined only by a sequence of random events. Whether spatial structures persist over long periods of time involves the time-series properties of key variables and the extent to which they change in response to shocks. From the definition of path dependency, even small temporary events can produce permanent effects on equilibrium outcomes.

However, once a housing choice is made, irreversibility implies that it is difficult to change the decision. Therefore, location choices are locked-in and persist.

Long-Run Housing Studies

Long-run studies in housing economics are in their infancy despite the fundamental importance of spatial lock-in. Since the physical structure of cities is highly persistent and the best locations are in fixed supply, segregation or self-selection in urban housing markets is always likely to occur. Nevertheless, there has been a range of empirical studies in related fields on which housing could draw. Davis and Weinstein (2002) use the case of World War 2 bombing of Japanese cities and a random walk model; they conclude that the population growth rates of bombed cities quickly recovered in the post-war period, despite the widespread destruction and, therefore, exhibit mean reversion. By contrast, if population shares exhibit a random walk, then temporary shocks, such as a war, have permanent effects. Related work on the long-run effects of wars can be found in Nitsch (2003) and Bosker et al. (2007). Recently in this journal, Sanso-Navarro et al. (2015) use the random walk model to examine the effects of the American Civil War on relative city population sizes.

Housing Supply and Land

Much of the research discussed above concentrates on housing *demand*. In addition, an important part of the literature considers housing *supply*, notably spatial differences (both within and between countries) in the price elasticity of housing supply and the implications for housing affordability. Low elasticities imply an upward trend in real house prices, whereas high elasticities suggest price stationarity. Furthermore price bubbles are less likely to occur when the price elasticity of supply is high. Goodman and Thibodeau (2008) and Glaeser et al. (2008) both argue that the areas of the US that experience the strongest supply responses are less prone to bubbles. There is a consensus on the variables affecting construction – house prices (both the level and rate of change), construction costs, credit costs and availability, topography, land use regulation (including wild-life protection), uncertainty, impact fees, time on the market, the weather, spatial spill-overs, crowding out – although no study includes all these factors together (see Ball et al. 2010 for a recent survey).

Time-to-build is a fundamental characteristic of construction and particular attention to this characteristic, which adds dynamics to an otherwise static model, has been paid by Coulson (1999), Topel and Rosen (1988) in the US and Tsoukis and Westaway (1994) in the UK. Because of the adjustment costs faced by builders, expectations of future prices have to be formed and expectations and uncertainty introduce a further strand of the literature. Particularly, when future conditions are uncertain – including the probability of obtaining planning permission – there is an

incentive to delay construction at a time of price volatility (see Mayo and Sheppard, 2001, Cunningham, 2006). Pryce (1999) suggests that uncertainty may give rise to backward-bending supply curves. Even if prices are currently rising and it is profitable to build, it may still be better to delay construction if prices are expected to rise further, because building today, in effect, gives up a valuable future option.

A large number of papers incorporate direct measures of land use controls into construction studies. In the UK, a series of papers by Bramley and collaborators are particularly well known, Bramley (1993, 1993a, 1998, 1999, 2002), Bramley and Leishman (2005). US examples include Mayer and Somerville (2000) and Green et al. (2005). More indirectly, Malpezzi and Maclennan (2001) conduct a comparative analysis of supply elasticities for the UK and US and infer differences in the impact of controls. Malpezzi and Mayo (1997) conduct a similar comparison for Malaysia, Korea and Thailand. Counter-intuitively, Meen and Nygaard (2011) find that price elasticities of supply are higher in the urban locations of South East England than on green fields, despite the fact that the latter are cheaper to develop; this reflects the more rigorous planning controls on green field sites, which prevent development. In the US, the construction of the nationwide Wharton Residential Land Use Regulatory Index (Gyourko et al. (2008) has been particularly useful in empirical work into housing supply elasticities. Recently, Hilber and Vermeulen (2014) examine the impact of supply constraints on house prices at the local authority level in England.

Selected Recent Papers in Urban Studies

The review in the last section shows the many contributions of *Urban Studies* in housing economics. This section concentrates on a sub-sample of recent papers and deliberately adopts an interdisciplinary perspective as a guide to the directions in which housing economics might develop. Some of these have a new focus, whereas others are extensions to earlier directions. The papers are chosen as being highly policy-relevant, but also adopt pluralistic approaches. As noted above, the standard residential location model and its extensions are valuable in some circumstances, but alternatives might be more appropriate in others, including agent-based social interactions models and institutional/historical methods. The chosen papers, therefore, use a wide variety of methodological approaches and innovation in methods is one of the criteria for inclusion.

The first two papers are chosen as inter-disciplinary agenda-setting pieces of research which have implications for the directions of spatial housing economics, although their interest is much wider. York et al. (August 2011), is concerned with a central issue in housing economics (both from neo-classical and social interactions perspectives) - segregation and clustering – but set in a long-run historical context, the value of which was stressed in the last section. The authors argue that their

work “combines elements of systematic and intensive strategies of comparison”. Furthermore, “systematic comparisons typically involve large-number random sample strategies and the statistical analysis of many variables” whereas “intensive comparisons employ fewer cases and greater social and historical contextualisation” (page 2401). They identify a number of classes of factors that drive segregation, which include macro-structural processes, the role of the state, local institutions and bottom-up processes (the combined effects of individual action). The classification is applied to three case studies – 9th-10th century China; 19th Century Algiers; late 20th century Prague. The long-run historical perspective teaches us that segregation has not always been an inevitable process and, importantly, changes in spatial patterns typically emerge in response to large shocks – dynastic change in China, the transition from Ottoman to French rule in Algiers, the fall of the socialist government in Prague. In terms of the lessons for spatial housing economics, the paper illustrates that urban dynamics are highly persistent, change takes place in response to major events such as wars rather than gradually, so that methods in housing are needed that do not necessarily assume that change is smooth.

The second paper, Storper (September 2010), is a review of the causes of differences in city growth rates. Storper pays particular attention to the role of institutions in the broad sense defined by North (2005), including laws, formal structures and social norms and networks. The regulation of land use by local authorities is one example. Following the discussion in the last section, many economists argue that land use regulation, particularly through its effects on house prices, has strong effects on business activity. Perhaps, rather against the conventional wisdom, Storper asks, “whether regulation significantly affects overall regional housing stock changes, or whether it principally affects intraregional distribution of changes in housing stock”. This is an important under-researched question in housing economics; do controls simply displace activity to other areas rather than affecting the overall number of homes? However, the value of Storper’s paper is wider than this and has implications for housing research in general equilibrium contexts. As a contrast, the third paper, Cheshire and Sheppard (April 2005), is representative of a strong strand of recent British housing economics research, but with wider applicability to other countries, that stresses the negative effects for the economy as a whole of some planning controls. In this paper, Cheshire and Sheppard propose the introduction of land prices, to signal shortages, into the decision-making process; the need may seem obvious to economists, but has been lacking in planning and the wider policy community.

The next set of papers is concerned with novel methodological approaches and applications relevant to housing, covering spatial econometric techniques, agent-based models, and simultaneous models

of spatial structure and residential sorting. The fourth paper, Fingleton (July 2008), takes the important and recurring housing policy problem in many countries of affordability and models the local inter-connections between housing demand, supply and labour markets, using theoretical models of monopolistic competition and increasing returns. Other joint models of affordability exist, but the analysis is conducted for fairly fine spatial units – the English local authorities – which imply that spatial interactions across both housing and labour markets are strong. This, in turn, requires the application of spatial econometric techniques. As noted above, most applications in housing economics, so far, have been confined to the analysis of house price interactions, but Fingleton's study is more ambitious, both in terms of the development of techniques and through its joint analysis of housing and labour markets.

The fifth paper, Yin (December 2009), is an example of the application of agent-based interactions modelling techniques, in this case to the dynamics of residential segregation in the city of Buffalo, using micro data. From the last section, the antecedents for models of this type lie in the classic work of Thomas Schelling (1971), but have subsequently evolved further. Here, simple rules for household location choices, related to racial composition and housing sale prices, generate the patterns of segregation. Therefore, the study includes both economic and racial influences. ABMs are an important simulation tool for housing markets and give rise to systems properties that conventional representative agent models cannot, but they are still work in progress. For example, at one level, the simplicity of the rules is an advantage, but future empirical work on their validation is still needed. Also issues of housing market search, which are important in the housing economics literature, need to be explored further since, in principle, one might expect search costs and other housing market imperfections to be important to the evolution of spatial outcomes.

The sixth and seventh papers can be taken together, partly because they share one common author and are related, shedding light on the extensive literature on neighbourhood effects. Hedman and Galster (January 2013), attempt to integrate the literatures on neighbourhood choice and selection and the effects of neighbourhood on individual incomes. Because of the difficult econometric issues that arise, notably biases arising from selection and endogeneity, the latter is a highly contentious topic, but important from a policy perspective, since it determines the effectiveness of place-based initiatives, where housing policies are central. A considerable volume of research on the topic has used random assignment experiments, often based on data from the Moving to Opportunity Programme, but this paper adopts a simultaneous equation approach, where household and neighbourhood income are jointly determined. Analysis is conducted on a large panel data set for Sweden, using instrumental variables to overcome the endogeneity. Under this approach, Hedman

and Galster find strong effects from the influence of neighbourhood. In addition to providing a valuable summary of previous approaches, Galster et al. (December 2010) use time differencing of a Swedish longitudinal data set in order to eliminate unobserved time-invariant characteristics, which could be correlated with the neighbourhood indicators. They find that the influence of neighbourhood is nuanced; some groups, in this case, parents and those who do not work full time are affected. Nevertheless, the influence of neighbourhood on subsequent economic outcomes remains contentious and MTO studies typically find only limited effects. Work is likely to continue.

The next two papers are representative of the literature on immigrant housing demand for home ownership. The issue is important because, in many developed economies, future household growth will be strongly affected by immigrant flows and because immigrants have differing tenure patterns from domestic residents; at least initially migrants have lower rates of home ownership, although Canada appears to have been an exception in the past (Haan 2005). But tenure patterns converge over longer periods of time. A number of country-based studies of migrant home ownership could have been chosen, which use related approaches, for example, Haan (November 2005), Sinning (February 2010), Nygaard (August 2011). However Painter and Yu (March 2014) and Constant et al. (August 2009) are taken here. The first paper is particularly interesting because, based on US data, it contrasts domestic and migrant mobility, household formation and home ownership before and immediately after the Global Financial Crisis (2006 and 2009). Primarily based on probit analysis, differential effects are found. Although the recession typically had negative effects on ownership patterns as expected, this was not unambiguously the case for migrants in all locations, particularly in small metropolitan areas. Constant et al. consider migrant home ownership rates in Germany, the country that has the lowest ownership rate in Europe. Again using a probit approach to the probability of ownership, the authors examine not only traditional variables (the economic and demographic characteristics of each migrant, length of time since migration), but also measures of ethnic identity. Those migrants that display a stronger attachment to the host country are more likely to become owners.

The next set of papers is concerned with the determinants of residential sorting and segregation. Again there is a choice of possible candidates, but, as illustrative, Clark and Morrison (November 2012), Zorlu and Latten (August 2009) and Ibraimovic and Masiero (March 2014) are highlighted. All are empirical, but raise interesting methodological issues; the first deals with New Zealand; the second with the Netherlands and the third with Switzerland. Clark and Morrison bring to the fore the under-explored question of regression to the mean in modelling residential location decisions. Those leaving the most and least deprived areas move up and down towards the mean neighbourhood

level. Nevertheless, even controlling for mean reversion, those departing from the most deprived areas are less likely to upgrade if they have low incomes. The relatively higher mobility of high income households in deprived areas undermines efforts to regenerate deprived neighbourhoods. Zorlu and Latten consider ethnic differences in mobility and the location choices of immigrants and domestic residents; differences between the two have contributed to an increase in segregation in urban areas. Non-western migrants are less likely to choose locations that have high proportions of domestic residents, whereas domestic households are more likely to choose such locations. Whereas Zorlu and Latten's research is based on a large individual data base, Ibraimovic and Masiero take a different approach based on relatively small sample stated preference experiments. The paper attempts to unravel voluntary preferences for segregation as opposed to those imposed by the nature of the housing market. The results reveal some, although not strong, evidence of a preference for co-location amongst the same ethnic group and the avoidance of other ethnic concentrations.

The final two pieces consider very different dimensions of housing from the above, but are increasingly important. Arguably, they are under-researched by housing economists. Given the rise in urbanisation in developing economies, the issue of slum dwellings and their health implications are of critical concern. Therefore, the first paper by Jorgenson et al. (December 2012) assesses the extent to which urban slum living affects child mortality rates by continent, notably Africa, Asia and Latin America, and whether change has taken place over time. The study covers a wide sample of developing countries in 1990 and 2005 and, using fixed effects panel models, show a positive association between slums and mortality, with stronger effects in Africa. The final choice, Hazam and Felsenstein (December 2007), examines the effects of terror on the Jerusalem housing market (prices and rents) between 1999 and 2004. They show that random terror has strong effects on property prices. The paper draws on the insights of behavioural scientists, a collaboration that is beginning to become more widespread in housing economics and the paper attempts to model the effects of fear rather than the objective risk. The paper also employs spatial econometric methods (see above) to allow for spatial dependence on prices, through a spatial lag specification.

Gaps in the Literature

So where are the gaps and directions for future research? First, there is scope for the further incorporation of spatial econometric methods. Local and regional house price interactions have been a popular area for testing new econometric techniques, including spatial econometrics. Nevertheless, there should be a word of caution. Spatial econometric techniques are good at

capturing the nature of spatial interactions, typically through spatial weights matrices, but, perhaps, have made less progress in explaining the causes of the interactions. This is particularly the case amongst ripple studies, where the underlying drivers remain incompletely explained. Technique and measurement are important, but they are not sufficient. Nevertheless, examples of good practice are given above and the methods can usefully be applied to other areas.

Second, agent-based models are a valuable tool for understanding the evolution of cities, but, at least in the housing field, are still based on simple, untested rules. ABMs and conventional economic models are often seen as alternatives, but in principle they can be integrated. Meen and Meen (2003) make some suggestions. However, the problems should not be under-estimated, not least because social interactions take place at small spatial scales and the relevant data are rarely available. Third, housing economics would benefit from testing the importance of institutional structure to the evolution of urban dynamics. This goes beyond the role of land-use planning systems, but, as above, recognises that different institutional structures have long-term implications for the development of cities. But, again, this needs detailed data over long time periods. History and path dependence are central in such analysis.

Fourth, a key issue for housing economists concerns the impact of housebuilding on biodiversity. The international evidence on the relationship between population density and species richness is summarised in Luck (2007), but more research is required. Urban sites are not necessarily environmentally-barren and former industrial sites demonstrate the resilience of the natural environment, having the ability to be repopulated relatively quickly by wildlife, but Helm and Hepburn (2012) argue that 'biodiversity loss should be regarded as one of greatest economic problems of this century'. Nevertheless, in practice, the fusion of an economic analysis of housing markets and biodiversity has yet to take place in an integrated framework. Similarly, the implications of climate change and flooding for housing have not, perhaps, attracted as much research as might be expected given its potential importance, beyond hedonic studies. The work of Chen et al. (2013) and Pryce et al. (2011) provide exceptions. Fifth, many of the highlighted papers are concerned with distributional issues arising from housing; equally important is housing's contribution to differential productivity and output growth across space. Work on the effects of neighbourhoods on future life chances is an important example, but not sufficient. Finally, Big Data methods are now attracting a great deal of attention and are an exciting research direction. We await the implications for housing economics research.

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